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AUTHOR McGinnis, J. Randy; And Others
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ABSTRACT

The objective of this study was to gather information about and assess the accessibility, use, and perceived needs toward computing technologies of elementary, middle school and high school science teachers in two large rural school districts. A questionnaire of over 500 items, Survey of Usages of Computing Technologies in Science and Mathematics Teaching, was designed and developed. Attitude and belief items were developed or modified from previous assessment instruments for science, mathematics, and other disciplines. Responses were received from 122 elementary school teachers (a 60% return rate) and 30 middle school and high school teachers (a 70% return rate). Information was collected on the following topics: (1) availability of computers; (2) level and types of computer use; (3) beliefs about computer use; and (4) current conditions and conditions needed or desired for using computing. All respondents reported having basic computer skills; 72% reported intermediate skills. Fifty-one percent of the elementary teachers agreed that computers would improve science instruction; however, 63% of the middle and high school teachers believed that computers would not improve science instruction. (17 tables) (KR)

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Beliefs and Perceived Needs of Science Teachers Toward the Uses of Computing Technologies

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J. Randy McGinnis, Patricia E. Simmons, Mary Atwater
Department of Science Education

Larry Hatfield, John Olive, Annita Hunt
Department of Mathematics Education

The University of Georgia
Athens, GA 30602

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Abstract

The Office of Technology Assessment predicts that more than four million microcomputers will be in the schools by 1994. In the last ten years, computing technologies and the uses of these technologies have increased in the public school setting. Approximately one-fourth of high school science teachers use computers; however, the pattern of computer use is low at all grade levels and in all subject areas. Previous surveys have shown that most science educational software in use is drill and practice, followed by tutorials, programming, and word processing.

The objective of this study was to gather information about and assess the accessibility, use, and perceived needs toward computing technologies of elementary, middle school and high school science teachers in two large rural school districts. A questionnaire, Survey of Usages of Computing Technologies in Science and Mathematics Teaching was designed and developed.

One hundred and twenty-two elementary school teachers responded to the questionnaire (sixty percent return). Ninety-three percent of the respondents indicated they used a computer; ninety percent felt they possessed basic competency skills (turning computer off/on, using a diskette). Approximately twenty percent used a computer often at home and in the classroom, while thirty-eight percent reported using them more than twenty-one days in the school year. Only eleven percent had access to a computer at home to assist in planning. The Apple IIe or IIc was the most commonly reported used computing system. Eighty percent reported using it. IBM and compatibles followed with a sixteen percent reported use. Thirty-nine percent had access to classroom computers with large projection screen, sixty-two percent had a separate computer lab, and around one in five respondents had a computer area in class.

More than eighty percent of the elementary teachers indicated that they never used computers to calculate grades, to manage instruction, to develop curricular materials, to generate simulation, or to gather and analyze data. Approximately half of the elementary teachers reported that they never use computers to solve problems, to test knowledge of facts, to explore patters and relationships or to explore a scientific concept. Ninety-one percent indicated they never use a computer to develop scientific processes. When asked if they would like to use computers for instructional activities, eighty-four percent indicated they would use them to test knowledge of facts, sixty-eight percent to gather and analyze data, and eighty percent to solve problems, respectively. The instructional use of computers most selected by teachers was word processing

(thirty percent), followed by calculating student grades, and managing instruction (seventeen percent each). Ninety-three percent of the teachers indicated that on site support by computer trainers is a must or helpful condition for using computers at the school. And over fifty percent reported that they must have training in technology as a condition for using computers at the school.

Thirty middle school and high school teachers responded to the questionnaire (seventy percent return). All respondents indicated that they used a computer and had basic competency skills when using the computer. More than one fourth of the teachers had access to a computer at home to assist in planning, forty percent had access to classroom computers with large projection screens, seventy percent had a separate computer lab, and fourteen percent had a computer area in class. Ninety percent received no courses on computers in science education during undergraduate or graduate school. More than fifty percent of the teachers indicated that they never or rarely used computers to calculate grades, to manage instruction, or to develop curricular materials. More than fifty percent of the teachers indicated that they never used computers to generate simulation data or to investigate a simulation. More than seventy percent indicated that they never used computers to conduct a scientific investigation or to use telecommunications. More than half of the teachers indicated that they never used computers to solve problems, to gather and analyze data, or to test knowledge of facts. When asked if they would like to use the computer for these instructional activities, fifty-seven percent said they would like to use computers to test knowledge of facts, forty percent to gather and analyze data, and less than thirty percent to solve problems, respectively. In general, teachers felt the most important instructional uses of computers to be the practice of learned skills (thirty-six percent), followed by conducting a scientific investigation (thirty-three percent), the testing of knowledge of facts (twenty-eight percent), and the simulating of science processes (twenty-seven percent).

As more applications of computing technologies continue to emerge in science education, teachers need to develop their professional skills in employing this powerful medium to enhance their students' learning. Many studies in science, mathematics, and other areas have yielded evidence supporting the arguments that the appropriate use of computing technologies can result in significant enhancements in student learning. The findings from this study supported the generalizations and trends reported in prior assessments of computer use by teachers.

The implications for science educators from these results is that teachers need to be more cognizant of how to implement computing technologies to aid in management and curricular planning and in instructional applications with students. Further research is needed to gain greater insight into K-12 teacher attitudes, beliefs, values, perceived needs, intended behaviors and actions regarding the uses of computing technologies.

Introduction

The Office of Technology Assessment predicts that by 1994 more than four million microcomputers will be in the schools. In the last ten years, computing technologies and the uses of these technologies have increased in the public school setting. Approximately one-fourth of high school science teachers use computers; however, the pattern of computer use is low at all grade levels and in all subject areas (Becker, 1986).

Surveys conducted by Becker (1986) the National Science Teachers Association (1987) and others have shown that most science educational software in use is drill and practice, followed by tutorials, programming, and word processing. Information from these most recent surveys on current uses of microcomputers and software indicated that computer-using teachers perceived that student motivation, student-student cooperation, student independence, and opportunities for high ability students all increased when using microcomputers (Kulik, Kulik, & Cohen, 1980; Kulik, Bangert, & Williams, 1983; Lawton & Gerschner, 1982; Menis, 1984; Schmid, 1990). Clearly, the appropriate use of microcomputers and educational software can result in desirable cognitive and affective learning outcomes for science students.

Purpose and Design of the Study

The objective of this study was to gather information about and assess the accessibility, use, and perceived needs toward computing technologies of elementary school, middle school and high school science teachers in two large rural school districts. The research question addressed in the study was: What beliefs and perceived needs do science teachers hold toward the uses of computing technologies?

A thirty page questionnaire, Survey of Usages of Computing Technologies in Science and Mathematics Teaching, containing over five hundred items was designed. Attitude and belief items were developed or modified from previous assessment instruments from science and mathematics education and other disciplines (Abdel-Gaid, Trueblood, & Shrigley, 1986; Baird, Rowsey, Easterday, & Smith, 1989; Bear, Richards, & Lancaster, 1987; Berdie, Anderson, & Niebuhr, 1986; Bitter & Davis, 1985; Burns & Bozeman, 1981; Butts, 1983; Clement, 1981; Cooper & Pace, 1982; Hasan & Billeh, 1975; Kathwohl, 1985; Krynowsky, 1985; Vermette, Orr, & Hall, 1986; Withey & Jaeger, 1985). The questionnaire contained sections of items organized into the following categories:

A. Availability of computers

Sample items:

1. How many computers do you have available for use in class? Number: _____
   Type: (a)__ Apple, (b)__ IBM, (c)__ other(specify) _____

2. Frequency of availability (check one):
   (a)__Every class, (b)__Once a Day, (c)__2 or 3 times a week,
   (d)__Once a week, (e)__Less than once a week, (f)__Not available

B. Level and types of computer use

Sample items:

Indicate (with an X) how often <u>your students</u> have used a computer in the following locations during the past year:

Often	Sometimes	Never	
1. ( )	( )	( )	Your classroom
2. ( )	( )	( )	A designated area outside your classroom
3. ( )	( )	( )	A media center or library (but not a lab)
4. ( )	( )	( )	A media center or library (but not a lab)

C. Beliefs about computer use

Sample items:

1. Teachers who use a computer for personal purposes are more likely to use a computer in their teaching.
   ( )Strongly Agree, ( )Agree, ( )Undecided, ( )Disagree, ( ) Strongly Disagree

2. Students who use a computer in science class will have difficulty learning basic science facts.
   ( )Strongly Agree, ( )Agree, ( )Undecided, ( )Disagree, ( ) Strongly Disagree

D. Current conditions and conditions needed or desired for using computing

Sample items:

Have it now? Yes	No		Must Have	Helpful To Have	Not Needed	Not Desirable
( )	( )	1. A computing area in my classroom	( )	( )	( )	( )
( )	( )	2. A compatible computer in my home for planning and preparing instruction.	( )	( )	( )	( )

The items were reviewed by a panel of science and math educators prior to inclusion in the pilot questionnnaire. The pilot questionnnaire was tested on a sample population of teachers to help establish the validity of items. The revised science questionnaire was then disseminated to all (thirty) middle school and high school teachers and all elementary teachers (two hundred and four) in the two representative school districts. Teachers who returned the questionnaire received a small honorarium. The response rate to the questionnaire was seventy percent.

Description of the Two Large Rural School Districts

Teachers surveyed in this study teach in two large rural school districts in a southern state. Descriptions of each county follow. Pseudonyms have been assigned to maintain anonymity.

First County

First County has a long history; it was created as a county just prior to 1800. Its area is approximately 400 square miles. The population per square mile is nearly thirty. Slightly over twenty percent of the land is used for farmland. The primary agriculture use of the land is for cattle grazing and chicken raising (Bachtel, 1990).

The total population of the county is approximately ten thousand. African-Amercians make up fifty-three percent of the population. Caucasians make up the remainder. There are approximately four thousand households in the county with an average size of nearly three members. The proportion of the population between five and nineteen, the typical school age group, is nearly thirty percent. The median age of the population is just under thirty years. The largest municipaility in the county contains three thousand three hundred poeple. A projection of the population for the year 2000 is fifteen thousand.

Nearly twenty percent of the families in First County are female headed. Sixty-five percent of those female headed families report containing children under eighteen years of age. Slightly over five percent of the total households in the county receive public assistance, AFDC. Around three percent of the children under age eighteen are on public assistance.

The three largest reported occupations reported in First County are machine operators/assembiers/ inspectors, precision production personnel, and laborers. Farming followed with approximately nine percent. The per capita income reported in 1987 was slightly under eleven thousand dollars.

There are four schools in the county. Three are elementary and one is secondary. One hundred and fifty-one teachers teach in those schools Forty-four percent of those teachers hold advanced degrees, placing the county in the sixtiest percentile in the state. The total student enrollment is approximately two and a half thousand. The average daily attendance is nearly ninety-five percent. The reported dropout rate for grades eight through twelve is slightly over five percent. The cost per student is around three thousand dollars. Average of eighty percent of the students pass basic skills tests in reading, writing, and mathematics. The median education level of the First County is slightly over tenth grade.

Second County

Second County also has a long history, but it is around thirty years younger than First County. Its area is approximately three hundred square miles. The population per square mile is nearly one hundred, three times larger than First County. Thirty percent of the land is used for farmland. The primary agriculture use of the land is for cattle grazing and chicken raising (Bachtel, 1990).

The total population of the county is approximately thirty thousand, nearly ten times First County's population. Caucasians make up seventy-nine percent of the population. African-Americans make up the remainder. There are approximately eleven thousand households in the county with an average size of nearly three members. Similar to First County, the proportion of the population between five and nineteen, the typical school age group, is nearly thirty percent, and the median age of the population is just under thirty years. The largest municipality in the county contains approximately ten thousand people. A projection of the population for the year 2000 is fifty thousand.

Approximately ten percent of the families in Second County are female headed. Fifteen percent of those female headed families report containing children under eighteen years of age. Less than three percent of the total households in the county receive public

assistance, AFDC. Six percent of all children in the county under the age of eighteen are on public assistance.

The three largest reported occupations reported in Second County are machine operators/assemblers/inspectors, precision production personnel, and clerical work. Three percent report being farmers. The per capita income reported in 1987 was slightly over twelve thousand dollars.

There are eight schools in the county. Four are elementary and four are secondary. Three hundred and sixty-one teachers teach in those schools. Thirty-seven percent of those teachers hold advanced degrees, placing the county in the fourteenth percentile in the state. The total student enrollment is nearly six and half thousand. The average daily attendance is nearly ninety-five percent. The reported dropout rate for grades eight through twelve is slightly under eight percent. The cost per student is two thousand six hundred dollars. An average of eighty-five percent of the students pass basic skills tests in reading, writing, and mathematics. The median educational level of the Second County is nearly eleventh grade.

Results and Discussion

Middle and Secondary School Teachers

The demographic information of the teachers in the sample group revealed the following: equal percentages of male and female teachers; ninety percent were Caucasian and ten percent were African-American; the age range included twenty-seven percent below thirty, forty percent in their thirties, thirty-two percent older than forty; ninety percent were certified in their teaching field; the years of teaching experience included forty percent early career teachers (1-5 years), thirty-six percent mid-career (6-14 years), and twenty percent veteran teachers (15+ years). The primary career goals of most teachers during the next five years were to improve their teaching and to study for an advanced degree. Refer to Table 1.

Insert Table 1 about here

Computer Experience/Accessibility:

All respondents indicated that they used a computer and had basic competency skills when using the computer (such as inserting discs). Seventy-two percent indicated they had intermediate level computer skills (such as making a backup copy, printing and so forth). Fifty percent used a computer outside of class, while thirty-six

percent used a computer in class. Ninety-five percent used Apple computers. Thirty-six percent used a computer in school ranging from two days to ten days per year. Only one person used a computer more than fifty days during the school year.

Currently, more than one quarter of the teachers had access to a computer at home to assist in planning, forty percent had access to classroom computers with large projection screens, seventy percent had a separate computer lab, and fourteen percent had a computer area in class. Refer to tables 2 and 3.

Insert Tables 2 and 3 about here

Training & Staff Development

Over half of the sample indicated that they received no inservice training or staff development in using computers. Ninety percent received no courses on computers in science education during undergraduate or graduate school. Refer to table 4.

Insert Table 4 about here

Non-instructional Uses of Computers

More than fifty percent of the teachers indicated that they never or rarely used computers to calculate grades, to manage instruction, or to develop curricular materials. This contrasted with their responses on items which asked "Would you like to use ....?". On these items, more than sixty percent responded that they would like to use computers to calculate grades, to manage instruction, and to do word process on a frequent basis. Refer to table 5.

Insert Table 5 about here

Instructional Uses of Computers

Responses to items focussing on the instructional uses of computers in the classroom yielded some interesting trends. More than fifty percent of the teachers indicated that they never used computers to generate simulation data or to investigate a simulation. More than seventy percent indicated that they never used computers to conduct a scientific investigation or to use telecommunications. Thirty-eight percent indicated that they never used a computer to demonstrate a science concept. When asked to respond to the "Would you like to use ...?" stems of analogous items, approximately

fifty percent of the teachers indicated they would like to use computers to demonstrate a science concept and to conduct a scientific investigation. Less than forty percent indicated that they would like to use computers to generate simulation data, to investigate a simulation, or to use telecommunications. Refer to Table 6.

Insert Table 6 about here

More than half of the teachers indicated that they never used computers to solve problems, to gather and analyze data, or to test knowledge of facts. When asked if they would like to use the computer for these instructional activities, fifty-seven percent said they would like to use computers to test knowledge of facts, forty percent to gather and analyze data, and less than thirty percent to solve problems, respectively. Almost sixty percent of the teachers indicated that they never used computers to explore patterns and relationships or to develop scientific processes. More than half indicated they would like to use computers in this way.

In general, teachers felt the most important instructional use of computers was the practice of learned skills (thirty-six percent), followed by conducting a scientific investigation (thirty-three percent), the testing of knowledge of facts (twenty-eight percent), and the simulating of science processes (twenty-seven percent). Refer to table 7.

Insert Table 7 about here

On items where respondents selected a five point Likert scale response (strongly agree to strongly disagree range), teachers were asked to respond to beliefs involving computer use. More than half of the sample felt that the use of computers in their classrooms would not improve science instruction, would not help develop science concepts, would not help students visualize science concepts, and would not help improve students' attitudes toward science. Refer to table 8.

Insert Table 8 about here

Conditions Needed for Using Computing Technologies

More than fifty percent of the teachers indicated that they must have the following to effectively implement computing technologies: selected computer-based

instructional software, adequate accessories (printers) and supplies, training on the technology and technology tools, and a commitment from the Board of Education and from the school administration. Refer to table 9.

Insert Table 9 about here

Elementary School Teachers

The demographic information of the teachers in the sample group revealed the following: ninety-five percentage were female teachers; seventy-two percent were Caucasian and twenty-eight percent were African-American; the age range included twenty-six percent below thirty, thirty-nine percent in their thirties, thirty-five percent older than forty; ninety-five percent were certified in their teaching field; the years of teaching experience included thirty-seven percent early career teachers (1-5 years), thirty-two percent mid-career (6-14 years), and thirty-one percent veteran teachers (15+ years). The primary career goals of most teachers during the next five years were to improve their teaching and to study for an advanced degree. (See Table 1.)

Computer Experience/Accessibility:

Ninety-three percent of the respondents indicated that they used a computer and had basic competency skills when using the computer (such as inserting discs). Forty percent indicated they had intermediate level computer skills (such as making a backup copy, printing and so forth). Seventeen percent used a computer outside of class, while sixteen percent used a computer in class. Eighty percent used Apple computers. Thirty-three percent used a computer in school ranging from one to twenty days per year. Thirty-eight percent used a computer more than twenty-one days during the school year.

Currently, eleven percent of the teachers had access to a computer at home to assist in planning, twelve percent had access to classroom computers with large projection screens, sixty two percent had a separate computer lab, and seventeen percent had a computer area in class. Refer to tables 10 and 11.

Insert Tables 10 and 11 about here

Training & Staff Development

Over two-thirds of the sample indicated that they received inservice training or staff development in using computers. Seventy-five percent received no courses on computers in science education during undergraduate or graduate school. Refer to table 12.

Insert Table 12 about here

Non-instructional Uses of Computers

More than eighty-four percent of the teachers indicated that they never or rarely used computers to calculate grades, to manage instruction, or to develop curricular materials. Their responses to items which asked "Would you like to use ....?". On these items, more than thirty-four percent responded that they would like to use computers to calculate grades, to manage instruction, and to do word process on a frequent basis. Only twenty-seven percent indicated they would like to use computers on a frequent basis to develop curricula materials. Refer to table 13.

Insert Table 13 about here

Instructional Uses of Computers

Responses to items focussing on the instructional uses of computers in the classroom yielded disturbing trends. More than eighty percent of the teachers indicated that they never used computers to generate simulation data or to investigate a simulation. More than ninety percent indicated that they never used computers in telecommunications. Forty-two percent indicated that they never used a computer to demonstrate a science concept. When asked to respond to the "Would you like to use ...?" stems of analogous items, thirty percent of the teachers indicated they would like to use computers to demonstrate a science concept. Sixteen percent indicated that they would like to use computers often to conduct a scientific investigation. More than 40 percent of the teachers indicated that they would never use computers to generate similar data. Ten percent or less indicated that they would like to use computers to generate simulation data or to use telecommunications. Refer to table 14.

Insert Table 14 about here

More than half of the teachers indicated that they never used computers to solve problems, to gather and analyze data, or to test knowledge of facts. When asked if they would like to use the computer on a sometime basis for these instructional activities, more than fifty percent said they would like to use computers to test knowledge of facts to gather and analyze data, and to solve problems. Almost fifty percent of the teachers indicated that they never used computers to explore patterns and relationships. Ninety percent never used computers to develop scientific processes; less than half indicated they would like to use computers in this way (to develop scientific processes).

In general, elementary teachers felt the most important instructional use of computers was word processing (30%), followed by calculating grades (thirty percent) and managing instruction (seventeen percent). Refer to table 15.

Insert Table 15 about here

On items where respondents selected a five point Likert scale response (strongly agree to strongly disagree range), teachers were asked to respond to beliefs involving computer use. More than sixty percent of the sample felt that the use of computers in their classrooms would improve science instruction (sixty-two), would help develop science concepts (seventy-five), would help students visualize science concepts (eighty-five), and would help improve students' attitudes toward science (sixty-nine percent). Refer to table 16.

Insert Table 16 about here

Conditions Needed for Using Computing Technologies

Approximately fifty percent of the teachers indicated that they must have the following to effectively implement computing technologies: adequate accessories (printers) and supplies, training on the technology and technology tools, and a commitment from the Board of Education and from the school administration. Refer to table 17.

Insert Table 17 about here

Implications for Research and Teacher Education

As more applications of computing technologies continue to emerge in science education, teachers need to develop their professional skills in employing this powerful medium to enhance their students' learning. Many studies in science, mathematics, and other areas have yielded evidence supporting the arguments that the appropriate use of computing technologies can result in significant enhancements in student learning (Clement, 1981; Cooper & Pace, 1982; diSessa, 1987; Educational Research Service, 1983; Hawkins & Pea, 1987; Menis, 1984). The findings from this study supported the generalizations from prior assessments on computer use by teachers.

In order to address the goals of science education for K-12 students and meet the needs of society, as outlined in the NSTA position statement, computer literacy and an understanding of science and the role of technology are critical. Computers can serve as a nexus to transform and revolutionize the way science teachers view thinking and learning. Consequently, teachers need to examine the attitudes and beliefs which influence their teaching. If the sample of teachers described in this study is representative of middle school and high school teachers in rural districts, more emphasis needs to be placed on teacher preservice and inservice experiences which focus on appropriate uses of computer technologies to enhance students' understanding of science. It is interesting to note that most of the teachers were not aware of the potential role which computing technologies could fill in innovative science teaching. Clearly, the implications for science educators are that teachers need to be more cognizant of how to implement computing technologies to aid in management and curricular planning and in instructional applications with students.

The findings in this study indicate that elementary teachers and middle and high school teachers use computers at different rates and in different ways in their classrooms and hold different beliefs about how computers should be used. Sixty-three percent of the middle and high school teachers in this study believed that using computers in their classsrooms would not improve science instruction, while 51 percent of the elementary teachers agreed that computers would improve science instruction. Therefore, any inservice computer experiences offered to these different groups of teachers must vary to be effective.

Further research needs to be conducted to gain greater insight into K-12 teacher attitudes, beliefs, values, perceived needs, intended behaviors and actions. On site interviews have been completed with the middle and secondary teacher sample. Currently, elementary teachers are being interviewed to gather more information from

the respondents on their attitudes and beliefs toward science and science teaching and their perceptions about the kinds of support (personnel, mechanisms, materials) and experiences which are necessary and desirable for the implementation of computing technologies. This information will enable science educators to incorporate experiences which will aid science teachers in their efforts to address the goals on science and technology supported by the National Association of Science Teachers and to plan more relevant and appropriate learning experiences for the education of their students.

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Table 1

Demographic Information from Elementary and Secondary Teachers

Teacher Responses (%)	Elementary	Secondary
Gender		
Male	5	50
Female	95	50
Ethnicity		
African-American	28	9.1
White	72	90.9
Age		
Below 30	26	27.3
31-39	39	40.9
40+	35	31.8
Teaching Certificates		
Provisional	3	9.1
Certified	95	91.9
Number of years teaching experience		
Early career (0-5 years)	37	40.9
Mid career (6-14 years)	32	36.3
Veteran (15+ years)	31	22.7
Undergraduate Majors		
Biology	--	33.3
Agronomy	--	9.5
Agricultural Ed.	--	9.5
Health Ed.	--	9.5
Graduate Degrees		
Master of Education	35	35.3
Master of Science	0	9.1
Specialist in Education	3	4.5

Table 2

Computer Use and Skill Level of Secondary Science Teachers

Level & Type of Computer Use by Secondary Teachers	Percent
Used a computer	100
Use a computer frequently	
In Classroom	36
Outside Classroom	50
Types of computers used[1]:	
Apples	95
Macintosh	13
IBM	22
Other	27
Number of days in school year that computer is used	
0 days	36
2-10 days	36
20 days	22
50 days	4
Distribution of days computer is used spread over year	36
Basic skills[2]	100
Intermediate skills[3]	72
Advanced skills[4]	
High	38
Medium	9
Low	13
None	4
Highly Skilled at evaluating software	23

(N=22)

1. more than one choice allowed
2. turn computer on/off, insert disc
3. make a backup copy, print
4. spreadsheet, word processing, data base

Table 3

Secondary Science Teachers' Perceptions of Current and Needed Conditions for Using Computing Technologies as a Resource (%)

Resource Needs	Current Condition (Using/Present)	Future or Needed Conditions: Must have	Future or Needed Conditions: Helpful to have	Future or Needed Conditions: Unnecessary
Materials to teach computer use	14	32	64	4
Materials on how to apply computers to teaching	27	41	59	0
Computer area in class	14	27	59	14
Separate computer lab	68	27	54	18
Computer lab which is networked	5[2]	14[1]	57	28
Modems	0	9	59	31
Computers with color graphics capability	36	23	73	4
Selected computer-based instructional software	59	55	45	0
Computer resource person	43[1]	29[1]	71	0
Easily accessible technical support personnel	32	29[1]	71	0
Adequate accessors (e.g. printers)	32	64	36	0
Adequate supplies (e.g. diskettes)	36	55	45	0

[1]N=21, [2]N=19, N=22

Table 4

Secondary Science Teachers' Perceptions of Current and Needed Conditions - Hardware Needs (%)

Hardware Needs	Current Condition (Using/Present)	Future or Needed Conditions: Must have	Helpful to have	Not needed
Computer for each student	0	18	41	36
Computers to be shared among students	9	28	68	4
Classroom computers with large screen projections	39	41	54	4
Computer at home to use for planning	27	36	50	17

(N=22)

Table 5

Non-instructional Uses of Computers by Secondary Teachers

Uses of Computers:		Currently Use	Would like to Use
		Percent	Percent
To calculate grades	Never use Often use	54 22	9 72
To manage instruction	Never use Often use	57 14	0 61
To word process	Never use Often use	13 31 77	0 81 9
To develop curricular materials	Never use Often use	4	40

(N=22)

Table 6

Instructional Uses of Computers by Secondary Teachers

Uses of Computers		Currently Use	Would like to Use
		Percent	Percent
To demonstrate a science concept	Never use	38	0
	Sometimes	53	48
	Often	9	52
To generate simulation data	Never use	57	0
	Sometimes	0	72
	Often	42	28
To conduct a scientific investigation	Never use	57	0
	Sometimes	43	58
	Often	0	38
To use in telecommunications	Never use	71	10
	Sometimes	29	55
	Often	0	35

(N=22)

Most important instructional use of computers selected by teachers was word processing (50%)

Table 7

Instructional Uses of Computers by Secondary Teachers

Instructional Student Uses of Computers		Current Use	Would like to Use
		Percent	Percent
To solve problems	Never Use	57	0
	Sometimes	43	72
	Often	0	28
To gather and analyze date	Never Use	76	0
	Sometimes	20	60
	Often	4	40
To test knowledge of facts	Never Use	52	0
	Sometimes	44	43
	Often	4	57
To explore a scientific concept	Never Use	45	0
	Sometimes	51	55
	Often	4	45
To explore patterns and relationships	Never Use	59	0
	Sometimes	47	46
	Often	4	54
To develop scientific processes	Never Use	59	20
	Sometimes	47	21
	Often	4	59

(N=22)

Table 8

Beliefs of Secondary Science Teachers about Computer Use

Descriptor	Responses (Percent)				
Using computers in my classroom will:	SA	A	U	D	SD
Improve science instruction	0	4	9	63	22
Help develop science concepts	0	0	9	72	18
Help visualize science concepts	0	0	4	68	27
Help improve students' attitudes toward science	0	0	9	50	40

(N=22)

SA = Strongly agree
A = Agree
U = Undecided
D = Disagree
SD = Strongly disagree

Table 9

Secondary Science Teachers' Perceptions of Current and Future Computer Support Needs (%)

Support Needs	Current Condition (Using/Present)	Must Have	Helpful to have
Training on technology	59	50	50
Training on technology tools	55	59	41
On site support	23	32	64
Time during day for training	0[1]	32	64
Release time for planning implementation of technology	0[1]	32	64
Commitment from Board of Education	41	73	27
Commitment from school administration		59	41
Commitment from all system faculty in subject area	5[1]	27	68

(N=22)

Table 10

Computer Use and Skill Level of Elementary Teachers

Level & Type of Computer Use by Elementary Teachers	Percent
Used a computer	93
Use a computer often	
In Classroom	16
Outside Classroom	17
Types of Computers used:	
Apple IIe or IIc	80
Apple IIgs	10
Mac (Any)	8
Mac II	1
IBM PC, XT,AT	16
IBM Compatible	8
IBM PS/<31	2
IBM PS/<32	1
Other	10
Numbers of days in school year that computer is used	
0 days	18
1-10 days	15
11-20 days	18
21+ days	38
Distribution of days computer is used	
Spread over year	61
Basic skills[1]	90
Intermediate skills[2]	40
Advanced skills[3]	
high	38
medium	9
low	13
Highly skilled at evaluating software	8

(N=122)

1. Turn computer on/off, insert disc
2. Make a back up copy, print
3. Spread sheet, word processing, data base

Table 11

Elementary Science Teachers' Perceptions of Current and Needed Conditions for Using Computing Technologies as a Resource(%)

Resource Needs	Current Condition (Using/Present)	Future or Needed Conditions: Must have	Future or Needed Conditions: Helpful to have	Future or Needed Conditions: Unnecessary
Materials to teach computer use	50[8]	29	63	2
Materials on how to apply computers to teaching	45[2]	26[2]	64	4
Computer area in class	17[5]	16[2]	75	3
Separate computer lab	62	22[4]	59	14
Computer lab which is networked	21[5]	11[6]	52	25
Modems	1[7]	2[11]	47	45
Computers with color graphics capability	54[9]	8[8]	74	11
Selected computer-based instructional software	82[2]	39	54	2
Computer resource person	28[4]	21[5]	70	8
Easily accessible technical support personnel	45[3]	46	44	3
Adequate accessors (e.g. printers)	62[8]	49[8]	46	2
Adequate supplies (e.g. diskettes)	65[3]	52[4]	43	1

N = 118, [2]N = 116, [3]N = 113, [4]N = 117, [5]N = 120, [6]N = 107, [7]N = 115, [8]N = 114, [9]N = 112

Table 12

Elementary Science Teachers' Perceptions of Current and Needed Conditions - Hardware Needs (%)

		Future or Needed Conditions		
Hardware Needs	Current Condition (Using/Present)	Must Have	Helpful to have	Not needed
computer for each student	4	12	53	35
computers to be shared among students	47	28	57	14
classroom computers with large screen projections	10	16	69	14
computer at home to use for planning	9	12	61	26

(N = 122)

Table 13

Non-instructional Uses of Computers by Elementary Teachers

Uses of Computers:		Current Use	Would like to Use
		Percent	Percent
To calculate grades	Never use	90	22
	Sometimes	7	39
	Often	2	36
To manage instructions	Never use	86	27
	Sometimes	11	37
	Often	2	34
To word process	Never use	53	9
	Sometimes	33	45
	Often	12	43
To develop curricular materials	Never use	84	20
	Sometimes	10	50
	Often	4	27

(N = 122)

Table 14

Instructional Uses of Computers by Elementary Teachers

Uses of Computers		Currently Use	Would like to Use
		Percent	Percent
To demonstrate a science concept	Never use	44	9
	Sometimes	46	54
	Often	8	37
To generate simulation data	Never use	80	43
	Sometimes	9	47
	Often	0	10
To conduct a scientific investigation	Never use	84	22
	Sometimes	14	60
	Often	0	16
To use in telecommunications	Never use	95	41
	Sometimes	5	51
	Often	0	6

(N = 122)

Most important instructional use of computers selected by teachers was word processing (30%) followed by calculating students' grades and managing instruction (17% each)

Table 15

Instructional Uses of Computers by Elementary Teachers

Instructional Student Uses of Computers		Current Use	Would like to Use
		Percent	Percent
To solve problems	Never Use	66	18
	Sometimes	27	61
	Often	6	19
To gather and analyze date	Never Use	84	30
	Sometimes	14	50
	Often	1	18
To test knowledge of facts	Never Use	54	13
	Sometimes	28	45
	Often	16	39
To explore a scientific concept	Never Use	49	13
	Sometimes	43	55
	Often	7	32
To explore patterns and relationships	Never Use	54	12
	Sometimes	40	60
	Often	6	28
To develop scientific processes	Never Use	91	49
	Sometimes	6	39
	Often	0	7

(N = 122)

Table 16

Beliefs of Elementary Teachers about Computer Use (N=122).

Responses (Percent)

Using computers in my classroom will:	SA	A	U	D	SD
Improve science instruction	11	51	25	12	2
Help develop science concepts	8	71	21	0	0
Help visualize science concepts	10	75	13	2	0
Help improve students' attitudes toward science	5	64	18	3	0

SA = Strongly agree
A = Agree
U = Undecided
D = Disagree
SD = Strongly Disagree

Table 17

Elementary Teachers' Perceptions of Current and Future Computer Support Needs (%)

Support Needs	Current Condition (Using/Present)	Future or Needed Conditions: Must have	Future or Needed Conditions: Helpful to have
Training on technology	68[1]	54[2]	45
Training on technology tools	43[3]	48[4]	53
Training for other teachers in same area	62[3]	34[1]	65
On site support by trainers	32[5]	26[7]	73
Time during day for training	10[1]	47[4]	62
Release time for planning implementation of technology	8[3]	35[1]	66
Commitment from Board of Education	48[7]	38[1]	62
Commitment from school administration	57[5]	41[4]	58
Commitment from all system faculty in subject area	32[8]	32[3]	68

[1]N = 116, [2]N = 119, [3]N = 112, [4]N = 117, [5]N = 113, [6]N = 114, [7]N = 108, [8]N = 109